

DEVELOPMENT OF INNOVATIVE NUCLEAR REACTOR TECHNOLOGY TO PRODUCE PROTECTED PLUTONIUM WITH HIGH PROLIFERATION RESISTANCE — REQUIREMENT AND VALIDATION OF NUCLEAR DATA

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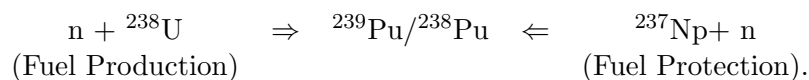
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Future Nuclear Energy will not be able to go forward without settlement of such issues as disposal of spent fuel (including interim storage issues), confinement or transmutation of radioactive wastes and nuclear proliferation. In order to resolve these problems, solutions of spent fuels and wastes and development of protected nuclear systems with enhanced non-proliferation capability are needed. For this purpose, a new concept called PPP (Protected Plutonium Production) has been proposed. This concept consists of fuel (²³⁹Pu) production from ²³⁸U neutron capture and ²³⁸Pu production for fuel protection from ²³⁷Np neutron capture.



The aim of this study is to develop advanced nuclear reactor technology by dispersing ²³⁷Np, presently treated as HLW, into U fuel for reduction of HLW, for achievement of high burn-up and for production of inherently protected plutonium.

For confirmation of the PPP Principle, irradiation tests of ²³⁷Np-U mixed samples are planned in the advanced test reactor (ATR) of INEEL. ATR is suitable for the short term irradiation test because of its high thermal flux level of 1×10^{15} n/cm²-sec. Post irradiation examinations (PIE) are also planned in ANL-W to obtain the nuclide composition data of Np, Pu, U, Am, Cm, which are needed to verify nuclear data and reactor core design method.

In this program, as for nuclear data, cross-sections, delayed neutron data and FP/ Alpha decay heat will be investigated from both the microscopic and macroscopic viewpoints. As integral tests, PIE data will be used in the analysis of irradiation experiments and the sample worth of ²³⁷Np will be measured by using Tank-type Critical Assembly (TCA) and Fast Critical Assemblies (FCA) of JAERI.

Present uncertainty of thermal capture cross-section of ²³⁷Np reaches up to 10%. This uncertainty should be reduced to several percent for reactor core design. The followings will be performed to ensure the calculation accuracy of the core with ²³⁷Np.

1. Improvement of reliability of the ²³⁷Np, ²³⁸Pu neutron cross-section data
2. Improvement of the energy release data for ²³⁷Np, ²³⁸Pu including the FP decay heat
3. Evaluation of the delayed neutron data for ²³⁷Np and ²³⁸Pu

The effect of nuclear data uncertainty of ^{237}Np on core physics characteristics will be studied by using currently available nuclear data files, e.g. JENDL-3.3, ENDF/B-VI and JEF-2.2 and the results will be presented in the forthcoming conference.